



ORIGINAL RESEARCH ARTICLE

An Analysis of Metered Dose Inhaler Use Technique among Patients

¹Dr. Vinit Prabhudas Niranjane

¹Assistant Professor , Department of TB & Chest / Pulmonary Medicine, Government Medical College & Hospital , Nagpur , Maharashtra , India

Abstract:

Introduction : Drug administration using a metered dose inhaler (MDI) device has become the mainstay of therapy in respiratory disorders, such as asthma and chronic obstructive pulmonary disease . Correct inhalation technique is critical in ensuring optimal drug delivery to the airways, and thereby its efficacy. However, erroneous inhalation technique is very common in patients with chronic airflow obstruction and hence, appropriate training is essential for all these patients to ensure optimal therapy. We attempted to analyze the technique of patients using manually operated MDIs, and again re analyzed after a structured educational intervention,

Methods: This Analytical study had a randomised, parallel-group design . Subjects were randomly selected from patients with respiratory disorders, aged 20 years and above, and Prior Consent from the patients were taken & was found to be within ethical standards. It was conducted among patients admitted to or attending to various local secondary health centres & tertiary medical care institutes selected randomly. Patients who did not self-administer their MDI or had linguistic difficulty in understanding the instructions were excluded from the study. A time period of Four months was chosen as the point of re-evaluation for inhaler technique.

Results: A significant difference was observed in the median score improvement achieved in the practical demonstration group compared with the written instruction group ($p < 0.001$). The median score achieved by the entire group was 3 (range, 1-8), which increased to 6, 7 and 8, respectively in the subsequent interventions. At the completion of three sessions of intervention, 98% of subjects were able to achieve a full score. Of these, 25% patients achieved a full score after the first intervention itself while 36% and 39 % patients reached the full score after 2 and 3 interventions, respectively.

Conclusion: There is a high prevalence of faulty usage of inhaler technique among patients. Repeated demonstration of the proper technique using a standard check-list significantly reduces the errors committed during inhaler use.

Key Word : MDI , Inhaler , COPD , NIH Guideline

Copyright: © 2011 The Authors. Published by Innovative Journal. This is an open access article under the CCBY-NC-ND license

1 | INTRODUCTION

Drug administration using a metered dose inhaler (MDI) device has become the mainstay of therapy in respiratory disorders, such as asthma and chronic obstructive pulmonary disease (COPD). It has the advantage that the drug is delivered directly to the site of need, which means a lower dose can be used to achieve the same effect as another preparation, and it has a reduced side-effect profile compared with other routes of administration.¹⁻² The advantages offered by this method are financial affordability, convenience, portability, quick and local action, and negligible systemic side effects.¹ The technique of inhalation is a major factor governing the efficiency of the inhaled medication. Correct inhalation technique is critical in ensuring optimal drug delivery to the airways, and thereby its efficacy. However, erroneous inhalation technique is very common in patients with chronic airflow obstruction,²⁻⁴ and hence, appropriate training is essential for all these patients to ensure optimal therapy.⁵⁻⁷

Previous studies have reported a high rate of inadequate inhalation technique varying from 77.5% to 89.2% depending on the type of inhalers used, the patient profile, and the methods adopted.⁸⁻⁹ In addition, a gradual temporal decline in the correct technique of inhaler use has also been observed.⁸⁻¹² However, a systematic assessment to determine the deficiencies in inhaler technique has not been carried out so far. This information is essential to plan a structured educational protocol while initiating patients on MDI therapy.

Thus, we attempted to analyze the technique of patients using manually operated MDIs, and again re-analyzed after a structured educational intervention, and to assess for any evidence of temporal decline.

2 | METHODOLOGY

This Analytical study had a randomised, parallel-group design. Subjects were randomly selected from patients with respiratory disorders, aged 20 years and above, and Prior Consent from the patients were taken & was found to be within ethical standards. It was conducted among patients admitted to or attending to various local secondary health centres & tertiary medical care institutes selected randomly. Patients who did not self-administer their MDI or had linguistic difficulty in understanding the instructions were excluded from the study. A time period of Four months was chosen as the point of re-evaluation for inhaler technique.

For the purpose of this study sample size was 100 patients with respiratory disorders using MDIs. Informed written consent from all the patients were obtained. All the patients were evaluated separately by two investigators. Each investigator was familiar with appropriate MDI technique and also attended a 3-day training session on the proper use of MDIs conducted by an experienced pulmonary physician. Baseline data was collected regarding patient demographics, history of the disease, use of respiratory medications, and previous MDI instructions. Patients were then asked to demonstrate how they self-administered their MDI, using a placebo. No oral instructions, prompts or critiques were provided by the observers prior to, during, or after this demonstration. Inhaler technique was evaluated using a standard check-list of recommended steps (National Institute of Health [NIH] guidelines) (Table 1)***, with 1 point given for each step performed correctly (maximum score = 8, "correct technique"). Following baseline assessment, randomised educational intervention was provided. The patients were divided randomly into two groups, with one group receiving written instructions regarding the correct technique step-wise (written instruction group) and the other group receiving practical demonstration by the instructor on the correct steps of using a placebo MDI (practical instruction group). The patients were then asked to demonstrate how they now used MDI using the placebo MDI and were evaluated with the standard check-list. The instructions and assessment of technique were repeated until the patient demonstrated the correct technique, or for a maximum of three times in the same sitting. The patients were followed up after four months and the technique of inhalation was re-evaluated using the same check-list. Those who failed to achieve full score were subjected to same interventions (written instruction / practical instruction) twice or till they received a full score, whichever came earlier. The instructions were based on NIH-Expert Panel 3 guidelines for inhaler usage.** The written instruction consisted of a pamphlet containing the steps in their preferred language (English / Hindi) which the patients were asked to read and follow. The practical instruction comprised of actual demonstration of inhaler use performed by the instructor using a placebo MDI. Data was filled in Microsoft Excel & analysed using the Statistical Package for Social Sciences (SPSS) for Windows version 19 & a computer software Epi Info version 6.2 (Atlanta, Georgia, USA). Quantitative and qualitative data were confirmed to be parametric and analyzed with student t test and Fisher exact test respectively. .

Corresponding Author: Dr. Vinit Prabhudas Niranjane

Department of TB & Chest / Pulmonary Medicine, Government Medical College & Hospital, Nagpur, Maharashtra, India

For paired observations (before and after treatment) paired t test was used for quantitative data and Mc Nemar's test was used for qualitative data.

3 | RESULTS

100 patients were finally analysed. The mean (\pm SD) age of the study group was 46.72 (\pm 14.38) years, and included 71 males & rest females. The mean (\pm SD) duration of symptoms and inhaler usage were 4.71 (\pm 4.8) years and 25.7 (\pm 19.5) months, respectively. Majority of patients (85%) were initiated on inhaler therapy in a secondary or tertiary center, with 56% reporting as having received prior inhaler therapy instructions by their prescribing physician. Only 38% of patients were using a spacer device regularly, while only 28% of patients reported having read the inhaler instructions given in the insert package. Of the whole group, 50 patients were randomly allocated to the written intervention and 50 were allocated to practical intervention.

The median score achieved by the entire group was 3 (range, 1-8), which increased to 6, 7 and 8, respectively in the subsequent interventions. At the completion of three sessions of intervention, 98% of subjects were able to achieve a full score. Of these, 25% patients achieved a full score after the first intervention itself while 36% and 39 % patients reached the full score after 2 and 3 interventions, respectively.

At baseline, the commonest errors observed were “not breathing out of the mouth before inhaling” (step 3) (86% of patients), and “not holding breath for 10 seconds or more” (step 7) (76%) .** In order to compare the efficiency of the interventions, the improvement in score after the first intervention was compared individually for both the interventions. A significant difference was observed in the median score improvement achieved in the practical demonstration group compared with written instruction group ($p < 0.001$).

Table 1. National Institute of Health-Expert Panel 3 guidelines for inhaler usage technique**

Step 1: Remove cap from the mouth-piece of canister, hold upright, with thumb below the base and finger on top of the canister

Step 2: For the first use or using after more than 7 days, shake and release one puff into air Step 3: Stand or sit straight. Breathe out through the mouth

Step 4: Place the mouth-piece between teeth and close lips without leaving any gap Step 5: Breathe in and release one dose with simultaneously breathing in Step 6: Remove the inhaler and close the mouth immediately Step 7: Hold breath for 10 seconds or as long as possible

Step 8: Wait for at least one minute before taking the second dose

4 | DISCUSSION

Improper inhaler usage is often one of the difficult aspect in the management of patients with respiratory disorders. We aimed to determine the extent of errors during inhaler use, as well as to assess the change after imparting appropriate education over a period of time. We observed that majority of patients had an improper inhaler technique when checked at random. Similar results have been observed in several other studies, with upto 76% of patients committing errors in inhaler use.⁸⁻¹³ It is a common observation that patients are not instructed regarding inhaler use at the time of initiating therapy. Even among our patients, only 56% had received prior education regarding use of inhaler technique, which is lower than that reported by Larsen et al ⁸ (63%), who conducted the study in a US population with 501 subjects. This does underline the need for devoting more time to a baseline demonstration and education when inhaler is prescribed for the first time.

The usage of a spacer device in our patient group was considerably low . The reasons for this could be multi-factorial, including financial constraints, the bulk and inconvenience to use or carry, or lack of prescription by the physician. However, with guidelines now advocating mandatory use of spacers along with MDIs, all educational interventions regarding technique of use of inhalers should include imparting knowledge of use of spacers as well.¹⁴⁻²² As baseline, virtually none of the patients achieved a perfect score on the inhaler check-list. The commonest errors were “omitting to exhale before inhaling”, and “not holding the breath for 10 seconds after inhaling”. Both these steps are important in allowing maximum inhalation and drug delivery.

We noticed a significant improvement in inhaler technique after a systematic education session. It is notable, however, that only 25% patients achieved a full score after one session of education; and it took three sessions for 98% patients to get a full score. This implies that multiple sessions and reinforcement is essential to achieve perfection in inhaler technique.

There are two common methods of patient education—one, to provide printed material / handouts containing pictures / text, and second, to impart actual physical demonstration of the technique. We compared both the methods in improving the technique of inhaler use. Our results showed that a practical demonstration is more effective than a written educational material in improving the inhaler use technique. These findings are consistent with previous studies, wherein a structured educational demonstration achieved a better result compared to provision of instruction pamphlets. [14-20] It is possible that this difference in outcome emerged due to the fact that steps, such as breathing in deep with mouth closed (Step 5)** demands higher skill development and understanding, which is better achieved when the patient actually observes the steps being demonstrated rather than simply reading them. It also suggests that greater emphasis should be laid on these specific steps during demonstration. [14-22]

We noticed a small but definite temporal decline in the scores achieved by the group when they were re-assessed after four months. This is a significant finding which has received less attention by the clinicians and the health educators alike, and underlines the need for repeated educational reinforcement to maintain a correct inhaler use technique.

5 | CONCLUSION

This study is not without limitations. A sample size of convenience was taken as we could not find any suitable reference to assist calculation of sample size. All patients using inhalers were recruited irrespective of the frequency and regularity of their usage. The check-list involved only a MDI and not a concomitant use of spacer device. Only MDIs were evaluated and dry powder inhalers were not included in the current study. In spite of these shortcomings, this study provides useful information regarding the errors committed by patients using MDIs and methods to correct these flaws. This may have important implications for disease management. Subsequent assessment of improvement in control of disease following correction of a faulty inhaler technique may provide more definite evidence of the practical importance of a systematic educational intervention even in busy clinics.

To conclude, there is a high prevalence of faulty usage of inhaler technique among patients. Repeated demonstration of the proper technique using a standard check-list significantly reduces the errors committed during inhaler use.

ACKNOWLEDGEMENTS

We would like to thank all the Participating patients , Our Head of Department for his always available guidance.

Compliance with Ethical Standards

Conflict Of Interest – None.

Funding – None.

Informed Consent Obtained.

5 | REFERENCES

1. Virchow JC, Crompton GK, Dal Negro R, Pedersen S, Magnan A, Seidenberg J, et al. Importance of inhaler devices in the management of airway disease. *Respir Med* 2008;102:10–19.
2. Melani AS, Canessa P, Coloretti I, DeAngelis G, DeTullio R, Del Donno M, et al. Inhaler mishandling is very common in patients with chronic airflow obstruction and long-term home nebuliser use. *Respir Med* 2012;106:668–76.
3. Capstick TG, Clifton IJ. Inhaler technique and training in people with chronic obstructive pulmonary disease and asthma. *Expert Rev Respir Med* 2012;6:91–101.
4. Coelho AC, Souza-Machado A, Leite M, Almeida P, Castro L, Cruz CS, et al. Use of inhaler devices and asthma control in severe asthma patients at a referral center in the city of Salvador, Brazil. *J Bras Pneumol* 2011;37:720–8.
5. Souza ML, Meneghini AC, Ferraz E, Vianna EO, Borges MC. Knowledge of and technique for using inhalation devices among asthma patients and COPD patients. *J Bras Pneumol* 2009;35:824–31.
6. Melani AS, Zanchetta D, Barbato N, Sestini P, Cinti C, Canessa PA, et al. Inhalation technique and variables associated with misuse of conventional metered-dose
7. Melani AS. Inhalatory therapy training: a priority challenge for the physician. *Biomed* 2007;78:233–45

8. Larsen JS, Hahn M, Ekholm B, Wick KA. Evaluation of conventional press-and-breathe metered-dose inhaler technique in 501 patients. *J Asthma* 1994;31:193-9.
 9. Thompson J, Irvine T, Grathwohl K, Roth B. Misuse of metered-dose inhalers in hospitalized patients. *Chest* 1994;105:715-7.
 10. Dolovich MB, Ahrens RC, Hess DR, Anderson P, Dhand R, Rau JL, et al. Device selection and outcomes of aerosol therapy: evidence-based guidelines. American College of Chest Physicians / American College of Asthma, Allergy, and Immunology. *Chest* 2005;127:335-71.
 11. Basheti IA, Reddel HK, Armour CL, Bosnic-Anticevich SZ. Improved asthma outcomes with a simple inhaler technique intervention by community pharmacists. *J Allergy Clin Immunol* 2007;119:1537-8.
 12. Self TH, Brooks JB, Lieberman P, Ryan MR. The value of demonstration and role of the pharmacist in teaching the correct use of pressurized bronchodilators. *Canadian Med Assoc J* 1983;128:129-31.
 13. Vaswani SK, Creticos PS. Metered dose inhaler: past, present, and future. *Ann Allergy Asthma Immunol* 1998;80:11-21.
 14. van der Palen J, Klein JJ, Kerkhoff AH, van Herwaarden CL, Seydel ER. Evaluation of the long-term effectiveness of three instruction modes for inhaling medicines. *Patient Educ Couns* 1997;32 (Suppl. 1): S87-S95.
 15. Lindgren S, Bake B, Larsson S. Clinical consequences of inadequate inhalation technique in asthma therapy. *Eur J Respir Dis* 1987;70:93-8.
 16. Hilman B. Aerosol deposition and delivery of therapeutic aerosols. *J Asthma* 1991;28:239-42.
 17. Labrune S, Chinet T, Huchon G. Inhaled therapy in asthma: metered-dose inhaler experience. *Monaldi Arch Chest Dis* 1994;49:254-7.
 18. Crompton GK. The adult patient's difficulties with inhalers. *Lung* 1990;168 (Suppl.):658-62.
 19. Crompton GK, Barnes PJ, Broeders M, Corrigan C, Corbetta L, Dekhuijzen R, et al. The need to improve inhalation technique in Europe: a report from the Aerosol Drug Management Improvement Team. *Respir Med* 2006;100:1479-94.
 20. Fink JB, Rubin BK. Problems with inhaler usage: a call for improved clinician and patient education. *Respir Care* 2005;50:1360-74.
 21. Bosnic-Anticevich SZ, Sinha H, So S, Reddel HK. Metered dose inhaler technique: the effect of two educational interventions delivered in community pharmacy over time. *J Asthma* 2010;47:251-6.
 22. Guidry GG, Brown WD, Stogner SW, George RB. Incorrect use of metered dose inhalers by medical personnel. *Chest* 1992;101:31-3.
- ** National Institute of Health. Guidelines for the diagnosis and management of asthma summary report. National asthma education and prevention program. Expert panel report 3: NIH Publication 2007;59-60